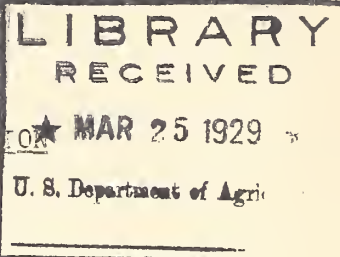


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REPORT OF PROGRESS OF THE BARBERRY ERADICATION  
CAMPAIGN IN COLORADO, 1928.

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Introduction

The barberry eradication campaign in Colorado is a part of the cooperative Federal and State campaign to eradicate the common barberry (Berberis vulgaris L.) from the grain-growing sections of the thirteen north-central States, Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming. The campaign was started in Colorado in 1918 by the U. S. Department of Agriculture, the Colorado State Entomologist's Office, and the Colorado Agricultural College. The project was started for the purpose of controlling the small-grain losses caused by black stem rust.

The losses from black stem rust gradually are being reduced in inverse proportion to the total number of barberries destroyed. Estimates by the U. S. Department of Agriculture place the average loss of wheat from stem rust, in the six years from 1915 to 1920, at more than 50,000,000 bushels of wheat per year in the barberry eradication States alone. This was before many barberries had been destroyed in the area. In the eight year period from 1921 to 1928 the average annual loss has been reduced to less than 16,000,000 bushels of wheat, a reduction of 34,000,000 bushels on the average each year. Other control measures, including the breeding of rust-resistant and early-maturing varieties, and the early seeding of crops have aided barberry eradication in accomplishing these results.

Barberry as a Source of Black Stem Rust in Colorado

Black stem rust is caused by a tiny parasitic plant closely related to such organisms as bread mold and the green mold of decaying fruit. This fungus parasite spends the greater part of its life on the wheat plant. Here it produces two kinds of spores, or rust "seeds", namely, red (summer) spores, which develop during the growing season, and black (winter) spores, which appear when the grain begins to ripen. These spores develop in pustules on the stems and leaves of the wheat plant. The black spores live through the winter on the straw and stubble and germinate in the early spring and produce a crop of very small colorless spores. These colorless spores are carried about by winds and many of them alight on the leaves of susceptible barberry bushes. Here they germinate and produce an infection which erupts the leaf surface in

groups of small cluster-cups. These cluster-cups contain thousands upon thousands of yellow, cluster-cup (spring) spores. These spores are forcibly discharged from their cups and, if carried to growing wheat, oats, barley, rye, or related grasses, are almost sure to cause an outbreak of stem rust on these hosts. This is the red rust stage. It is recognized by the appearance of brick-red, open pustules which contain thousands of red or summer spores. These may be blown to other nearby grains or grasses and in this way rust may spread within a few weeks over a wide area.

Thus in our latitude the common barberry plays a vital part in the life history and spread of black stem rust. Years of investigation have shown that this shrub is responsible for the spread of stem rust to wheat, oats, barley, rye, and about 70 different kinds of tame and wild grasses. By destroying the barberry throughout the State, epidemics of stem rust can be prevented.

#### How to Identify the Common Barberry

The common barberry is an erect shrub often growing to a height of 14 ft. The leaves are green or purple and are closely toothed around the margin. They occur in rosettes on the stem. There are three or more spines on the stem at the base of each leaf cluster. The outer bark is gray and the inner bark and wood are yellow. The yellow flowers and the red, oblong fruits are borne in clusters like currants. Every common barberry growing in Colorado is a menace to the small grains of the State and should be destroyed.

#### The Japanese Barberry

The Japanese barberry (Berberis thunbergii DC.) does not spread stem rust, and may be planted. It is a low shrub of spreading habit. The outer bark is reddish-brown in color. The spines usually occur singly on the stem. The leaves are spoon-shaped and smooth-edged. The yellow flowers and red berries are quite similar to those of the common barberry but are produced singly or in pairs more like gooseberries and not like currants. This bush is beautiful and makes a very fine hedge.

#### Barberries Native to Colorado

Besides the common and Japanese barberries, which have been introduced into Colorado, a native species (Berberis fendleri) has been found growing wild in the mountains near Pagosa Springs, and Durango, Colorado. This barberry is susceptible to black stem rust and should not be transplanted to communities in which small grains are grown.

#### Rust Spreads from Barberries

Many excellent examples of the spread of stem rust from barberries

to grains and grasses have been found and recorded in Colorado. Barberries frequently have been located by tracing the severity of the local stem-rust infection they caused. Farmers who have lived near to the harmful barberry bushes have testified to the damage that they have done to the grain crops. Records kept for a period of years after the barberries were removed from farms where stem rust had been heavy show that the local stem-rust epidemics disappeared with the removal of the bushes and that thereafter rust on these farms was no heavier than in the surrounding locality.

### Surveys for Barberries

Three types of survey have been used in Colorado. These are first survey, second survey, and the resurvey.

The first, or preliminary, survey was a property-to-property survey in cities, towns, and villages and a farm-to-farm survey of all rural properties in the State. The purpose of this survey was to secure the destruction of the largest number of bushes in the shortest possible time. Every barberry destroyed lessens the chance of stem-rust infection. Therefore at the beginning of the eradication campaign more emphasis was placed on destroying a large number of bushes than on getting every bush as the survey progressed. The first survey was completed in Colorado in 1924.

The second survey is more intensive than was the first survey. At the present time on this survey every foot of every property upon which barberries may be growing is searched. The field agents on the second survey locate not only the straggling bushes missed on the first survey, but also the new bushes which have grown from seeds scattered from the planted bushes by birds or other agencies.

Some one may ask if it would not have been better to have gone slowly on the first survey and taken time to find every bush. Had that plan been followed, only a small portion of the State would have been covered to date, and all of the bushes in the unsurveyed portion would have been causing damage during all of this time. Naturally some bushes were missed on the first survey, and these are capable of doing damage, but the chance of great damage was reduced materially in a few years by speeding up the work and covering the whole State.

Resurveys are reinspections of the properties on which barberries have been found and destroyed. Such resurveys are necessary to find and kill sprouts and seedlings developing where bushes were destroyed in the first or second surveys.

A check or third survey is necessary in some of the first counties that received a second survey. In these counties it was not thought advisable to cover every foot of ground thoroughly at the time of the second survey. Since that time it has been found essential to cover all natural



and planted timber, and all fence rows, rivers and ditches on second survey. This naturally slows up the progress of the work, but is necessary in order to locate all straggling bushes that were missed in former surveys.

### Difficulties of Survey

The task of finding every barberry in Colorado is not an easy one. Every foot of planted timber, all fence rows, and the banks of all rivers and ditches, must be surveyed thoroughly. Barberries have been found in many unusual places, including dense thickets of wild currants, gooseberries, and plums, under tangled vines and among the shrubs along the river banks.

Even if the scouting is done so carefully that no bushes are missed in a county, there is still danger that barberry seeds lying in the ground will germinate and grow at some future time. This makes it necessary to cover some counties several times before they can be pronounced entirely free from these rust-spreading bushes. The job in this State is not nearly complete. Years will have passed before the last barberry is found in Colorado.

### Eradication

Prior to 1923 the problem of completely eradicating barberries was extremely difficult. Bushes were dug or grubbed out or pulled out with teams and tractors. However, this method of eradication proved to be very ineffective and costly. Small portions of the roots left in the ground grew again, causing sprouting bushes where the parent bushes had been destroyed. Thus it was necessary to return and dig the sprouting bushes.

Kerosene and crushed rock salt have been found to be effective and cheap killing agents, and these have been used in nearly every case since 1923. By the use of these two chemicals the sprouting bush has been eliminated except in those cases in which it still is necessary to dig barberries that are growing near valuable trees and shrubbery which might be killed by the chemicals as readily as would the barberries.

### Summary of Eradication Campaign 1918-1928

The results of the first survey carried forward throughout the field seasons from 1918 to Dec. 31, 1928, show that on the later date 25,502 common barberry bushes have been found in the cities, towns, and rural districts of Colorado. Of these 24,009 have been destroyed by digging and 1,489 by chemicals, making a total of 25,498 bushes destroyed. Some of these, though apparently killed, have produced sprouts from pieces of roots left in the soil. In resurvey during the entire campaign 6,997 such sprouting bushes have been found on 1,638 properties. Also, during the entire campaign 19,408 seedlings have been found

on 219 properties. This makes a total of 51,907 barberry bushes, sprouting bushes, and seedlings found in Colorado to Dec. 31, 1928. Of this number 51,903 have been destroyed.

### Progress in 1928

#### Surveys

In 1928, one major activity, second survey, was emphasized. This survey was carried on in two counties, namely Weld and Boulder. On this survey 124 bushes were found on 29 properties, and 64 seedlings on 3 properties.

Resurvey was carried on in Larimer County in the large escaped area west of Loveland. 6,988 seedlings were found scattered along the Big Thompson river from the mouth of the canyon to the city of Loveland.

#### Education and Publicity

During the past year 118 stories on barberry eradication were printed in city and farm papers. A total of 58 window-display demonstrations, and 3 county-fair demonstrations were placed. One demonstration was placed at the Western Stock Show. The field men, while working in their respective counties, distributed bulletins, barberry specimens and return post-cards to each rural mail box.

Educational materials for teaching the story of the barberry and its relation to black stem rust were sent to 428 schools, including grade schools, high schools, and colleges.

From Jan. 1 to Dec. 31, 1928, twenty-one farmer meetings were conducted in several communities of Arapahoe and Larimer counties. The average attendance was twenty. The meetings were held once a week and covered a period of five weeks in each community. Considerable interest was shown at these meetings.

As a result of this past year's educational and publicity campaign five new properties having eight barberries were found.

#### Investigations

The chief investigational work carried on in Colorado includes a study of the occurrence and spread of stem rust. Surveys are made each year to determine the prevalence and severity of stem rust and the damage that it has caused to small-grain crops. Studies on the epidemiology of stem rust are carried on in order to determine what influence the weather and other growth factors may exert in bringing on an epidemic of this disease. The spread of stem rust from barberries to susceptible grains and grasses also is noted. The probability of stem-rust epidemics from inoculum blown into the State, and the possibility of overwintering the

red stage of this disease in Colorado and its return to small grains and grasses without the aid of the barberry, are given attention. The information thus far obtained in these studies indicates that the common barberry is the main source and probably the only important source of stem rust in this State.

The U. S. Department of Agriculture, in cooperation with other States in the eradication area, carries on investigations which include: (1) the classification of barberries and other closely related plants; (2) the testing of barberry species, varieties, and hybrids for their susceptibility to stem rust; (3) studies in connection with the problem of chemical eradication; and (4) the longevity of barberry seeds when buried in the soil.

#### Other Control Measures

In addition to eradicating barberries, there are other control measures for stem rust. These include the breeding of resistant varieties, the use of early-maturing varieties, and the early seeding of the crops. All of these measures should be continued simultaneously with barberry eradication wherever possible. Barberry eradication and the breeding of rust-resistant varieties both offer great possibilities for the control of stem rust. These two lines of attack on the rust problem should continue in harmony until the losses from this disease are reduced to a minimum.

#### Conclusion

As early as 1891 severe local attacks of stem rust were known in the North-Central, grain-growing States but, previous to 1904, there had been no widespread and destructive epidemic. In 1904 there was an epidemic of stem rust so severe and so widespread that it was of national importance. Again in 1911 a general loss occurred from stem rust, and in 1916 an extremely destructive epidemic occurred in the upper Mississippi Valley, causing an estimated loss of more than 180,000,000 bushels of wheat.

Stem rust became a limiting factor in small-grain production. Wheat-growing was abandoned in many sections of the United States. Barberry eradication was started in 1918 to reduce these losses by black stem rust. This was not a new idea, because campaigns to eradicate barberries had been carried on by many European countries with splendid success. Laws were passed in some of the New England States as early as 1775 prohibiting the growing of common barberries. The part that the barberry played in spreading stem rust was definitely known as early as 1865.

While it will take some time to find and destroy all of the barberries in the North-Central States, the task is not hopeless. Losses from stem rust have been decreased, and may be reduced to a minimum if every citizen in the eradication area will put his shoulder to the wheel and help in this control measure. Whenever a shrub is found which is believed to be common barberry, a sample of it should be sent for identification to the Barberry Eradication Office, Colorado Agricultural College, Fort Collins, Colorado.